AGRICULTURAL NEWS LETTER

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This publication gives information on new developments of interest to agriculture on laboratory and field investigations of the du Pont Company and its subsidiary companies.

In addition to reporting results of the investigations of the Company and its subsidiaries, published reports and direct contributions of investigators of agricultural experiment stations and other institutions are given dealing with the Company's products and other subjects of agricultural interest.

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Agricultural News Letter (du Pont)
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BETTER CONTROL OF CERTAIN FUNGOUS DISEASES OF PLANTS INDICATED BY EXPERIMENTS WITH A NEW COPPER FUNGICIDE

EDITOR'S NOTE:- This development offers further evidence of the value of research in better equipping growers with means to combat pests which damage useful crops. A center for such work is the du Pont Pest Control Research Laboratory, near Wilmington, Delaware.

The Grasselli Chemicals Department of E. I. du Pont de Nemours & Company, Inc., is making commercially available to growers a new fungicide -- "Grasselli Copper Compound - A". It was formerly designated for experimental purposes as "Basic Copper Chloride or Copper Oxychloride - A."

Better disease control, greater safety to plants, and simplicity of preparation and application without the addition of lime are among the indicated advantages of this compound.

Excellent control of certain fungous diseases is indicated by experiments and field tests by investigators of several agricultural experiment stations and experiments conducted by du Pont technical workers.

These tests also give evidence that the compound is generally safer to apply on copper-sensitive plants than is Bordeaux mixture. In addition, the spray mixture is easier to prepare than home-made Bordeaux, as it is necessary only to mix the compound with water in the spray tank.

Harvest records taken from test plots receiving this spray generally show higher yields than those obtained on adjacent plots receiving other treatments. Of especial note have been yield increases of celery, cherries, cucumbers, tomatoes and beans.

Directions for Use

Celery: For control of early and late blight, use 4 lbs. to 5 lbs. of Grasselli Copper Compound-A to 100 gallons of water. Thoroughly mix Grasselli Copper Compound-A with the water in the spray tank. When the tank is nearly full and with the agitator running, add 5 to 7 oz. of "Grasselli Spreader-Sticker," which should always be diluted with at least 10 times its volume of water before adding to the spray mixture.

Tests for the control of pink rot of celery with Grasselli Copper Compound-A have yielded promising results. However, because the sclerotia of the causal organism are soil-borne, the degree of control may vary considerably. Where

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control of pink rot is attempted by spraying, extreme thoroughness of application is very important. Particularly, cover thoroughly the lower portions of plants and soil beneath the plants with the spray; use as much pressure as possible.

Cherries: For controlling cherry leaf-spot, use 1-1/2 to 2 lbs. of Grasselli Copper Compound-A to each 100 gallons of water, the exact amount depending upon the recommendations of your Experiment Station. Use 4 oz. to 5 oz. of "Grasselli Spreader-Sticker" to each 100 gallons of spray mixture.

Cucumbers: Apply Grasselli Copper Compound-A as a dust for control of downy mildew, wilt and beetles. Prepare the dust in the proportion of 1 part of Grasselli Copper Compound-A to 14 parts of talc, bentonite or other commonly used diluents, except lime.

Tomatoes: Grasselli Copper Compound-A is recommended for controlling Macrosporium and Septoria leaf spot of tomatoes, which occur in the field, and Cladosporium leaf spot, which occurs in the greenhouse. Use Grasselli Copper Compound-A at the rate of 5 lbs. to 100 gallons of water, with 4 lbs. of flour added to each 100 gallons of spray mixture.

Beans: Use 5 lbs. of Grasselli Copper Compound-A to 100 gallons of water for the control of anthracnose and angular leaf spot. Add "Grasselli Spreader-Sticker" at the rate of 5 oz. to 7 oz. per 100 gallons of spray.

Ginseng: Good control of Alternaria blight has been obtained with 4 lbs. of "Grasselli Copper Compound-A to 100 gallons of water. Use "Grasselli Spreader-Sticker" at the rate of 5 oz. to 7 oz. per 100 gallons of spray.

GENERAL: In view of the relative safety of this new product to copper-sensitive plants, in the tests conducted, it is suggested that growers try it on a limited scale for other purposes, where Bordeaux is used, especially on plants, under conditions where Bordeaux causes injury. It is not necessary to add lime to this copper spray when used alone - add lime only in instances where it is applied in combination with other spray products that require lime as a protective agent, such as the arsenicals.

GRASSELLI SPREADER-STICKER

In many instances, best results from Grasselli Copper Compound-A have been obtained when used with "Grasselli Spreader-Sticker." This new type spreader and sticker is economical to use because only a little is necessary. It is easy to handle because it is a liquid. IMPORTANT: Always dilute the recommended quantity of "Grasselli Spreader-Sticker" with at least 10 times its volume of water before adding to the spray solution.

NORTH CAROLINA REPORTS PROGRESS OF EXTENSION PROGRAM OF COTTON SEED TREATMENT FOR CONTROL OF PLANT DISEASE

EDITOR'S NOTE:- The work reported here by Dr. Shaw was carried on by the North Carolina Agricultural Extension Service, I. O. Schaub, Director, with the United States Department of Agriculture cooperating. The author makes acknowledgements to several county agricultural agents for their assistance in supplying information. The tables and figure referred to in this article are omitted because of space considerations. Those desiring a complete copy of the report should address requests to Dr. Shaw.

By Luther Shaw, Extension Plant Pathologist,
University of North Carolina,
Raleigh, North Carolina.

The extension program on cotton seed treatment in North Carolina has now been underway for two years. During this period considerable information and experience on the subject have been accumulated, and some progress made in establishing the practice of cotton seed treatment among farmers of the state. At the request of many county agents a summary of results of the work done to date has been prepared. This report follows:

Materials and Methods

Three major extension procedures were followed in both 1936 and 1937, namely; (1) result demonstrations, (2) farmer meetings, and (3) release of timely news articles.

Result Demonstrations

A total of 143 result demonstrations have been completed. These demonstrations were distributed through 32 counties representing the major cotton-growing regions of the state. All of the demonstrations were conducted in essentially the same manner, which was as follows: Each demonstrator was given a small quantity of ethyl mercury chloride dust *(2% Ceresan), and in most cases was assisted in applying the dust to the seed. It is estimated that approximately 90 per cent of the seed used in the demonstrations was treated with the conventional rotary barrel type of treating machine. In the remaining cases the seed and dust were placed in a barrel which was then rolled on the ground. While this method gave satisfactory results the rotary barrel method is much to be preferred. The time the seed was treated varied from two months before to within a few minutes before planting. The time of treatment appeared to have

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no effect on the value of the treatment in disease control. Each demonstrator planted treated and untreated seed under similar conditions. In most cases a visit was made to each demonstration just before the cotton was chopped. At this time records were made of (1) the total plants emerge` per 100 feet of row, (2) total plants killed by damping off per 100 feet of row, and (3) percentage of the living plants with the sore shin stage of damping off. These records were made on both the treated and untreated plots. In September or October each demonstration was again visited and an estimate made of the yield of seed cotton. Details of the method used follows:

"At five selected points, measure 20 ft. in row middle, count the number of mature bolls on both adjacent rows. This will give the number of bolls on 40 ft. of row.

Add the five boll counts and divide by 5. This will give the average number of bolls per 40 ft. row unit.

Measure across field and divide the total number of feet by the total number of rows measured across. This will give the average width of row in feet. Reduce this figure in feet to inches.

Multiply average number of bolls per 40 ft. by factor for row width (column two). Result will be number pounds seed cotton per acre. (The factor in column two is calculated on basis of 70 bolls per pound of seed cotton.)

Column 3 gives number bolls per 40 ft. unit necessary to make a 500 pound bale per acre on basis of 70 bolls per pound seed cotton and 36 percent lint. Column 4 gives number bolls per foot of row necessary for 500 pound bale per acre."

1. Width of row, inches	2. Factor for total yield 70 boll per pound	3. No. bolls per 40 ft. unit for bale.	4. No. bolls per ft. for bale
30----------	6.22----------	223----------	5.5
31----------	6.02----------	231----------	5.8
32----------	5.83----------	238----------	5.9
33----------	5.65----------	245----------	6.1
34----------	5.49----------	253----------	6.3
35----------	5.33----------	260----------	6.5
36----------	5.18----------	267----------	6.7
37----------	5.04----------	275----------	6.9
38----------	4.91----------	283----------	7.1
39----------	4.78----------	290----------	7.2
40----------	4.66----------	297----------	7.4
41----------	4.55----------	305----------	7.6
42----------	4.44----------	312----------	7.8
43----------	4.34----------	320----------	8.0
44----------	4.24----------	327----------	8.2

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1. Width of row, inches	2. Factor for total yield 70 boll per pound	3. No. bolls per 40 ft. unit for bale	4. No. bolls per ft. for bale
45----------	4.14----------	335----------	8.4
46----------	4.05----------	342----------	8.6
47----------	3.97----------	349----------	8.7
48----------	3.88----------	357----------	8.9
49----------	3.81----------	364----------	9.1
50----------	3.73----------	372----------	9.3
51----------	3.66----------	379----------	9.5
52----------	3.59----------	387----------	9.7
53----------	3.52----------	394----------	9.8
54----------	3.45----------	401----------	10.0

During the two-year period both estimated and weighed yields were obtained on a total of 9 demonstrations. These records show for the 9 demonstrations an estimated average yield of 1,634 pounds of seed cotton per acre from treated seed and an actual yield of 1,584 pounds of seed cotton per acre on the same plots. In these cases the estimated yield was only 50 pounds higher per acre than the actual yield. It is evident from these figures that the method employed for estimating yields was sufficiently reliable for the purposes intended.

In all cases the yield of lint cotton was calculated on the basis of a 36 per cent yield of lint from the seed cotton. It is known that in some of the demonstrations the lint yield was higher and in some lower than 36 per cent. However, there is evidence to indicate that a 36 per cent lint yield is a reliable average for the group of demonstrations.

The value of the lint was calculated at 12¢ per pound for 1936, and 9¢ per pound for 1937. The value of the seed was calculated at $30 per ton for 1936 and $20 per ton for 1937. These figures represent the approximate average prices received during the stated years.

The cost of seed treatment was figured at 25¢ per acre. This figure was arrived at as follows: 2% Ceresan costs 75¢ per pound when purchased in 1 lb. cans. One pound of the material treated 5 1/3 bushels of seed. Hence the cost of the material was 15¢ per bushel of seed. A labor charge of 5¢ was allowed for treating each bushel of seed, making a total cost of 20¢ per bushel. The average rate of seeding for the 143 demonstrations was 5 pecks per acre, making the total cost of seed treatment 25¢ per acre. If the treating material is purchased in larger quantities and at a lower price per pound the cost of seed treatment per acre can be reduced considerably.

Farmer Meetings

Farmer Meetings were held in the ten counties where demonstrations were set up in 1936. A total of 31 Farmer Meetings in 25 counties were attended by the author in 1937. A large number of additional meetings and method demonstrations were conducted by county agents.

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News Articles

Three general news releases were made on cotton seed treatment in both 1936 and 1937: one release in March describing the object and method of seed treatment; one in June describing effects of seed treatment on the stands of cotton in the demonstrations, and one in October giving a report on the yields from treated and untreated seed in the demonstrations. In addition to this a large number of releases were made by county agents to their local papers.

Results

Results of the demonstrations on cotton seed treatment for 1936 are summarized in Tables 1 and 2, and Figure 1, and for 1937 in Tables 3 and 4, and Figure 2. The results presented in these Tables and Figures show that a substantially better stand of cotton was obtained from treated than from untreated seed. It is also evident that the better stand resulted largely from the control of damping off in the seedling stage by seed treatment. Finally, a greater yield of seed cotton per acre was obtained from treated seed, the difference being 247 pounds per acre in 1936, and 267 pounds per acre in 1937 in favor of treated seed. The increased yields evidently resulted primarily from the better stands of plants from treated seed. However, numerous observations and a limited amount of data indicate that a part of the increased yield resulted from a more rapid early growth and earlier maturity of the plants from treated seed.

The average gross returns per acre from seed treatment in the demonstrations was $13.05 in 1936, and $11.27 in 1937. Deducting the cost of seed treatment (25¢ per acre) it is found that the profit from seed treatment was, on the average, $12.80 per acre in 1936 and $11.02 per acre in 1937. Hence, at a cost of 25¢ per acre approximately enough was made to pay the fertilizer bill, or enough to pay for the cost of seed treatment for the next 50 years.

Prior to 1934 there was little to no cotton seed treated with 2% Ceresan in North Carolina with the exception of a few bushels used for experimental purposes. However, beginning in 1934 there has been a yearly increase in the adoption of this practice among cotton farmers of the state, beginning with 2000 acres planted with treated seed in 1934 and rising to 200,000 acres in 1937, the increase of 1937 over 1936 being 176,000 acres (Fig. 3). It is anticipated that another large increase in the acreage planted with treated seed will take place in 1938. A goal of 600,000 acres is set for the state (Fig. 3). County agents should bear in mind that in order to reach this goal it will be necessary to plant approximately 60 per cent of the acreage with treated seed in 1938.

Using the figures obtained in the demonstrations in 1936 and 1937 as a basis for calculation, it is estimated that adoption of the practice of cotton seed treatment by North Carolina farmers made them $20,000 in 1934; $70,000 in 1935; $300,000 in 1936; and $2,200,000 in 1937, a total of $2,590,000 to date. Using the same figures as a basis for calculation, failure to adopt the practice by farmers in the state resulted in losses of approximately $9,000,000 in 1934, $9,000,000 in 1935, $11,200,000 in 1936, and $8,200,000 in 1937, totaling $37,400,000. These figures should be a challenge to the county agents of North Carolina to continue their work on cotton seed treatment to the point that losses from damping off in this crop become negligible.

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*(Page 1) "Ceresan" Seed Disinfectant, 2% - "Ceresan" is a trade-mark registered in the U. S. Patent Office by Bayer-Semesan Company, Wilmington, Delaware.

Agricultural News Letter (du Pont)
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PERTINENT FACTS ABOUT TERMITES AND THEIR HABITS AND CONTROL MEASURES WHICH HAVE PROVED EFFECTIVE

EDITOR'S NOTE:- Extension workers and vocational teachers may find the information given here useful in their contact work, especially when addressing groups. What follows is from a talk on insects by Dr. Dietz at a meeting in Wilmington, Delaware.

By Harry F. Dietz, Entomologist,
Pest Control Research Laboratory,
E. I. du Pont de Nemours & Co., Inc.,
Wilmington, Delaware.

Much and frequently sensational publicity has been given to those reputed demons of the dark, the termites. They are rather closely related to the roaches, but independently and low in scale of insect evolution there has developed among termites a social system that is paralleled again only among the highest members of the insect order, namely the bees, wasps and ants. The study of social insects is always fascinating and attracts literary, philosophic and scientific attention, as witness Maeterlinck's Life of the Bee and Life of the Termite. Great care must always be taken not to explain the lives, actions and reactions of insects in terms of human traits and reasons.

Termites constitute a relatively small family of insects which has reached its peak in development and in number of species in the tropics and semi-tropics of the world. There the very curious and frequently enormous nests of these small, blind insects, working in a world of eternal darkness, excites the curiosity, the fancy, wonder and admiration of even the most callous observer. At most, only three species of termites occur in Delaware. All are native, subterranean or terrestial forms, which means that they must, like Antaeus of old, always have contact with the ground or they perish. From the ground, they obtain the moisture necessary to prevent their drying up and for softening the wood on which they feed.

The Place of Termites in Nature

In the economy of Nature, termites too are scavengers whose activities in past ages prevented the too great accumulation of large quantities of cellulosic or woody materials like fallen trees and leaves. When, within the past few hundred years large areas of woodland were both ruthlessly and, of necessity, slaughtered to make way for our present day civilization, there came a time when our native termites were confronted with a real food shortage. Any animal

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in nature confronted with such crisis always reacts in one of two ways. If its reactions and habits are inflexible or inadaptable, it perishes, but if these are adaptable and flexible the animal survives. It may even find the new conditions just as favorable as the old. In the latter case, it may become a real pest and a menace, as seems to be the case with the termites.

Since termites are social insects, we find a well organized caste system in their nests. There is the fertile egg-laying female or queen whose enormously swollen, sac-like body is nothing more than an egg-laying machine and prevents her moving from the royal chamber. Accompanying her is the male or king, a comparative dwarf besides his mate. There may be even more than one queen or one male in a large nest. Furthermore, supplementary queens and males are also found which were developed from the early stages of other castes. Then there are the big brown-headed soldiers with oversized sickle-shaped jaws, whose function is to prevent the invasion of the nest particularly by true ants, the natural enemies of termites. Finally, there are the blind, delicate, white, thin-skinned workers. These are undeveloped males and females, the food gatherers and digesters on whose activities the survival of the nest depends.

Termites devour cellulose, that ubiquitous material which occurs in cell walls of plants, often with other chemical compounds. Hence, dried plant or dried plant products, wood, cotton and linen cloth and paper are eaten by these insects. They also feed up on such dried animal products as leather. The conditions under which termites can become destructive are strictly limited. The black-bodied, glistening, white-winged, migrating forms cannot fly into a house and establish a nest in the kitchen, parlor, bathroom, sunporch or cellar unless they find a readily available and constant supply of moisture. Such supply is usually in the ground. Therefore, if termites gain access to houses or other wooden structures, it is usually by way of the ground, and, furthermore, by way of wood either in direct contact with the ground or readily accessible from the ground. I have said that termites are delicate, thin-skinned insects. They cannot withstand the desiccating effect of even a comparatively moist room. Hence, when they must traverse an open space, even for the shortest distance, they build moisture-proof runways over that surface. The workers build it from the inside and never venture beyond the open end. Likewise, here is where the soldiers perform their duty, for they always guard such openings and the workers gathered there. Now the term "easily accessible from the ground" simply means that the wood can be reached through runways so located that they cannot be reached and broken.

Proper construction to prevent termite damage means keeping untreated wood out of direct contact with the ground and so building that the avenues of accessibility from the ground to the wood can readily be examined. Termite infestations in buildings are always individual cases, because no two buildings are constructed alike. For example, I once examined a costly stone library in which the door casings, baseboards, and practically all wood finish in the basement storerooms were in contact with the ground. As a result, termites not only invaded this wood finish, but, by devious routes, got into and ruined valuable reference books on wooden racks which at various points were in contact with the finish. Such construction was made to order for termites. Another case

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was a house into which termites had invaded a wall and had reached the second story. The foundation was a hollow, concrete block. As you know, these blocks are so laid that the holes are usually over one another, forming solid wells or concrete tubes. Now, if termites get into these wells at some point and build their own runways inside, they have ready access to the wooden plate which caps these tubes. They can then work at will and leisure in the stringers, girders and walls. Therefore, if hollow, concrete block is used, it should be capped with a solid cement block before the plate is laid. If termite tunnels or their access to wood are broken, all of those above the break perish provided that the ground is their only constant, available and permanent supply of necessary moisture.

We could discuss termites, their life, habits, activities and importance the rest of the evening. However, I would be remiss if I did not clearly point out that although termites are capable of, and do, great damage, such damage is not necessarily general. There is no reason to believe that any of you will go home and find your floors or other parts of your house ready to collapse and precipitate you into the basement. If any of you do find termites, do not become frantic. Do not get the idea that the damage has been the result of a few weeks' or months' activity of these pests. It may have been going on for several years. Examine the construction for wood either in direct contact with the ground or accessible from the ground. If necessary, then call upon a competent entomologist to assist you and to advise the best remedial measure that fits your specific case, because it will be such a case.

Agricultural News Letter (du Pont)
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THE FACTORS FOUND ESSENTIAL FOR MAXIMUM EFFICIENCY OF FERTILIZERS AND SOME OF THE NON-ESSENTIAL ONES

EDITOR'S NOTE:- Significant changes which mark progress in the formulation of fertilizers are discussed here by Dr. Skinner, an outstanding authority. This article appeared under the title "What Do We Get In Improved Fertilizers?" in The Progressive Farmer, February, 1938.

By J. J. Skinner, Senior Biochemist,
Bureau of Chemistry and Soils,
United States Department of Agriculture.

Modern science continually strives to learn the why and wherefore of many things. In the agricultural field modern science has produced improved varieties of fruit and field crops, improved breeds of animals, better methods of production, and improved fertilizers.

Like most of our modern products, improved fertilizers were possible only after the agricultural scientist had ascertained the factors or properties that determine the quality or efficiency of fertilizers. Once those properties were definitely ascertained it was comparatively easy to produce improved fertilizers that possess all the properties essential to top performance.

The Progressive Farmer has asked me to discuss the factors found essential for the maximum efficiency of fertilizers. In doing this I will not only indicate the essential properties but will also mention some properties that are not essential.

Three Essential Plant Foods

It is well known that for most crops and soils in the Southeast nitrogen, phosphorus, and potassium are essential constituents of a fertilizer. The need for these plant food elements was so great that for many years they were considered the only essential plant foods in fertilizers. In following this idea agricultural scientists and fertilizer manufacturers developed and sold very concentrated fertilizers which contained two or three times as much nitrogen, phosphorus, and potash as ordinary fertilizers but contained practically none of the other essential plant foods. Such fertilizers did not prove satisfactory for cotton, potatoes, and other truck crops on many Southern soils. Their failure to prove satisfactory stimulated studies to determine the essential qualities of fertilizers. This marked the beginning of a period of intensive laboratory and field experimentation with these cheaper and newer fertilizer materials by scientists of the U.S.D.A. and state experiment stations, which

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resulted in the adaptation and successful use of concentrated fertilizers on Southern soils.

A consideration of those very concentrated fertilizers and standard fertilizers indicated the differences in efficiency may have been due to one or more of the following points:

1. Differences in sources of nitrogen.
2. Differences in content of the secondary elements calcium and magnesium.
3. Differences in acid-forming properties.
4. Differences in content of copper, boron, and manganese.

Scientists reported the results of experiments made with cotton and truck crops in the Southeast, in which the source of nitrogen in very concentrated fertilizers was varied widely to include different proportions of ammonia, nitrate, and soluble organic and insoluble organic nitrogen. Such changes did not materially alter the yields obtained with the very concentrated fertilizers. Apparently, therefore, the form or source of nitrogen used in the fertilizer was not of great importance.

Nitrogen Differences

Until recent years too much attention has been given to sources of nitrogen and too little attention to the fundamental properties associated with its different forms. Organic forms of nitrogen, such as fish scrap and cottonseed meal, are good not because of color, smell, or insolubility in water but because they are not very acidic and the nitrogen is not readily leached from the soil. Today those same fundamental properties can be more economically secured in other and cheaper materials or mixtures. In the extensive experiments of the U.S.D.A. and cooperating experiment stations the best yields of cotton and other crops have been secured with those forms of nitrogen which are soluble but which resist leaching when properly formulated with dolomitic limestone.

Acidity and Yields

The very concentrated fertilizers did not contain appreciable quantities of calcium or magnesium and were also quite acid-forming. The standard fertilizers with which they were compared contained considerable calcium and some magnesium and were only slightly acidic. In one experiment in North Carolina the standard fertilizer produced an average yield of 1,482 pounds seed cotton over a three-year period, while the acid-forming concentrated fertilizer, low in calcium and magnesium, produced only 1,266 pounds. However, when some limestone was mixed with the concentrated fertilizer it produced 1,703 pounds, 221 more than the standard. What did the limestone do? It furnished lots of calcium, some magnesium, and made the fertilizer non-acid-forming.

In a Georgia experiment a standard fertilizer produced a six-year average yield of 778 pounds seed cotton. A very concentrated fertilizer produced only 494 pounds. When limestone was mixed with the concentrated fertilizer it produced 707 pounds, and when both limestone and magnesium were mixed with it it produced 875 pounds, 97 more than the standard.

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Dolomite Ideal Supplement

The experiments cited, as well as others with cotton, Irish potatoes, sweet potatoes, and strawberries, very clearly showed the necessity of having calcium and magnesium in the fertilizer and of formulating the fertilizer so its continued use would not make a soil more acid. There were several ways in which this could be done. Experiments have conclusively shown that it can be economically and efficiently done by adding dolomite to the fertilizer mixture. Dolomite contains approximately 20 per cent magnesium oxide and 25 per cent calcium oxide and is one of the best materials for correcting acidity of soils or fertilizers. Since it contains 45 per cent plant food in addition to having high neutralizing value, dolomite may well be considered a concentrated fertilizer material.

In North Carolina an acid-forming 7-6-5 fertilizer made from ordinary materials produced an average yield of 186 bushels potatoes. A similar fertilizer supplemented with a calcium limestone to furnish additional calcium and to make it non-acid produced 210 bushels. An additional increase to 233 bushels was secured when magnesium was supplied in a soluble form. Finally the 7-6-5 was supplemented with dolomite and it produced a yield of 237 bushels. This and other experiments show that dolomite will do the threefold task of supplying calcium, supplying magnesium, and correcting fertilizer acidity.

Old-fashioned bulky fertilizers with lots of smell and a good dark color were good--better than some put on the market to take their place. We now know that it was not the smell, the color, or the big bag that made them good. They were good because the organic materials contained available calcium and magnesium and were not acid-forming. Some of the fertilizers that took their place were quite acidic and contained very little magnesium. In the old-fashioned fertilizers the presence of calcium and magnesium and a comparatively low acidity were accidental--incidental to securing nitrogen, phosphorus, and potash. Under that system it frequently happened that even the old-fashioned fertilizer was decidedly acidic and too low in magnesium for best results.

In the improved fertilizers manufactured nowadays these important properties are not left to chance. Calcium and magnesium are added in definite quantities. Likewise the fertilizer is formulated to be non-acidic, somewhat basic, or in special cases acidic, depending on the soil and crop requirements. The result is that improved fertilizers may be formulated with or without some of the old materials that contributed to bulk, color, and smell. Those old materials need be used only if and when they are economical sources of plant food.

The practical results of the findings of these soil authorities are that (1) the way is now clear for formulating improved fertilizers, (2) the plant food content of fertilizer may be substantially increased, and (3) the farm cost of plant food may be materially reduced. These points will be considered further in subsequent articles of this series.

To summarize, we may state the specifications of an improved fertilizer as follows:

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1. The fertilizer should contain adequate quantities of calcium, magnesium, and sulphur, as well as the so-called commercial plant foods, nitrogen, phosphorus, and potassium.

2. All the plant food elements should be completely available to the crop and at the same time as far as possible resistant to loss by leaching.

3. The continued use of the fertilizer should not have a harmful effect on the soil, such as making it too acid.

Agricultural News Letter (Du Pont)
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SHOOTING DRILLED WATER WELLS TO INCREASE THE FLOW CAN BE DONE SUCCESSFULLY BY EXPERIENCED BLASTERS

EDITOR'S NOTE:- This article, based on data contained in the Du Pont Blasters' Handbook, points the way to making many wells more efficient.

By L. F. Livingston, Manager,
Agricultural Extension Division,
E. I. du Pont de Nemours & Co., Inc.,
Wilmington, Delaware.

It is a more or less generally known fact that explosives have been used successfully for increasing the flow of drilled water wells. But the methods employed and certain factors to be considered are not so well understood. However, it is not the purpose of this discussion to attempt to give detailed instructions for doing the work; rather, it is to present here enough facts to clearly indicate that the work is thoroughly feasible.

It is hardly necessary to explain that nothing is to be gained by shooting, where a well is sunk into sand or gravel. Firing a blast at the bottom of a well in such materials would have practically no effect on the flow of the well, since the sand or gravel would simply settle back after the explosion into its original place in the porous mass.

If sunk into water-bearing rock, however, a well may draw only from the particular pores or crevices which it intersects and their tributary pores and fissures, and thus secure only a relatively small portion of the water carried by the whole stratum at that point. If passages could be opened into the bore hole from the whole area of surrounding rock, the flow of the well would be immediately increased. Here, therefore, is the function of explosives, for a heavy charge fired at the bottom of the well would increase the sectional area of the hole, making a collecting cavity for water, and would open up radiating fissures throughout a considerable area of the enclosing rock.

Loading Practices and Explosives to Use

The explosive is usually placed at the bottom of the hole. If a record of the hole has been kept by the driller, as should always be done, showing the kinds of material encountered in drilling, the depth and thickness of each successive layer and the point or points at which a water-bearing stratum was struck, this should be consulted by the blaster before deciding the location of the charge.

It sometimes happens that a hole is drilled through a water-bearing area into a lower dry area and in such a case the shot should be fired, not at the bottom of the well, but at the level of the water-bearing rock.

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Inasmuch as the greatest possible fracturing of the rock is desired, it is advisable to use a quick, powerful explosive and a heavy charge. But certain of these types of explosives are not obtainable in some localities, and they are not necessary in all cases.

Du Pont 60% Straight Dynamite will do thoroughly satisfactory work, provided the column of water which may be standing in the well is not over 200 feet high. The exact size of the charge is governed by the depth of the well, the nature of the rock to be blasted, and the proximity to buildings. For a well 100 feet deep, an efficient and safe charge would be from 150 to 300 pounds of 60% Straight Dynamite. For each additional 100 feet this loading could be increased by about 100 pounds.

Method of Placing the Charge

The cartridges are carefully packed in a cylindrical shell, ranging usually from three to five feet in length, made of tin or galvanized iron drawn out to a point at the lower end to prevent it from catching in its descent down the hole, open at the upper end provided with a wire handle or bail. Such a container can be easily made from an ordinary stovepipe. It should always be at least an inch smaller in diameter than the bore hole. If there is standing water in the hole, as is usually the case, and the hole is of considerable depth there should be an opening in the lower end of the shell, so that the water may pass through the shell and equalize the pressure on the explosive. When the shell is loaded, the bail is placed over a special hook on the end of a stout line and the shell is slowly lowered down the hole. By a few motions of the line the hook can then be freed and drawn up.

Priming and Exploding the Charge

After the charge is seated, the next step is to explode it. This can be done by either a jack squib, or an electric squib devised especially for oil-well shooting.

The jack squib consists of galvanized pipe about two inches in diameter and thirty-six inches in length, pointed at the lower end, which is filled as follows: Sand is poured into the pipe to a depth of about six inches; a cartridge of 60% Straight Dynamite, primed with two No. 8 blasting caps and two fuses, is seated on the sand, and more sand is poured in until it fills the space around the cartridges and covers it to within four inches of the top of the pipe. This remaining space is then filled with thick tar. As soon as the squib is prepared, both fuses are lighted, two being used in case one should fail, and the squib is dropped into the hole, point down. The length of the fuse should be so calculated that the squib will explode about the time it strikes the charge and thus detonate it. The electric squib of the oil-well shooter, which should not be confused with the du Pont Electric Squib, is similar in construction to the jack squib, but shorter and larger in diameter with a less sharply pointed end. It is usually about five inches in diameter and twenty inches long. It is filled to a depth of about six inches with sand and then a primer charge consisting of from one to three cartridges of 60% Straight Dynamite is placed in the sand, one of the cartridges having been

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previously primed with a No. 8 Special Waterproof Electric Blasting Cap. To the wires of this cap, at a point which will come well within the squib shell, are spliced No. 14-gauge copper wires long enough to reach to the bottom of the hole, and the splices are well taped. The remaining space is filled with sand and topped with a layer of tar. This squib is carefully lowered by the wires until it rests upon the charge. It is then fired by means of an electric blasting machine.

Safety Precautions Which Must Be Observed

The desirability of blasting a well should first be determined by careful study of its location, the drill log, and the water supply it is designed to draw upon.

Whether it is safe to blast depends largely upon the proximity to buildings and the depth of the well. If the well is in a city close to or within large buildings, it may be dangerous to blast, lest the shattering of the rock underground weaken the foundations of the buildings, or flying fragments of rock do damage above ground. If the well is shallow, any risk there may be of injury to surrounding property is increased.

Most drilled wells contain a casing throughout a part or the whole of their depth. Exploding a heavy charge at the bottom of the well is likely to damage this casing, either blowing it out in fragments, which may do harm if allowed to fly in the air, or causing it to collapse within the bore hole or splitting it longitudinally along the seam.

To prevent the casing from flying into the air it is well to build a heavy grill work over the mouth of the hole. This should be securely anchored to the ground. It is hardly possible to prevent splitting the casing, but this is not necessarily a serious result, for a casing that is merely split can easily be pulled out and replaced.

Additional Information Can Be Obtained

As is usually the case in the use of explosives, each well shot offers its own peculiar problem. It, therefore, is strongly urged that those interested in well blasting obtain not only complete information on the subject, but also discuss with an explosives expert the procedure in each instance. An illustrated folder is available and will be sent on request.

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